Computer Science 360
Midterm Examination

Time: 75 minutes   November 5,2002

Marks

4 1. (a) Explain how Dijkstra's algorithm needs to be modified to work on an edge weighted undirected graph.

16   (b) Give an example undirected graph G, with distinct integer edge weights for which the spanning tree, T_P, found by Prim's algorithm beginning at vertex v_1 is different from the spanning tree, T_D, found by Dijktra's algorithm when started at v_1. Construct your example so that T_P does not contain the shortest path from v_1 to every other vertex, and so that T_D is not a minimum total edge length spanning tree. Show G, T_P and T_D.

20 2. Provide a very efficient algorithm to solve the following problem. Given an directed graph G, is there a vertex v in G such that every other vertex in G can be reached by a path from v. What is the time complexity of your algorithm.

20 3. [Directed Hamiltonian Path] Given a directed graph $G = (V, E)$, the directed Hamiltonian path problem is to find a directed Hamiltonian path (a directed path with n - 1 edges that includes each vertex in V) in G or determine that such a path does not exist.

Give a recursive backtracking algorithm for the directed Hamiltonian path problem. Explain the state space organization used.